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Dr LEE, Kitae	Korea Atomic Energy Research Institute, Daejeon, Korea, 5 January 2004
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Dr JEONG, Young Uk	Korea Atomic Energy Research Institute, Daejeon, Korea, 5 January 2004
Dr SIDORIN, Anatoly	Joint Institute for Nuclear Research (JINR), Dubna, Russia, 5 - 6 February 2004
Dr SMIRNOV, A	Joint Institute for Nuclear Research (JINR), Dubna, Russia, 5 - 6 February 2004
Prof LIN, Yuzhen	Tsinghua University, Beijing, China, 17 March - 5 April 2004
Prof SYRESIN, Evgeny	Joint Institute for Nuclear Research (JINR), Dubna, Russia, 31 January - 6 March 2004
Prof MESHKOV, Igor N.	Joint Institute for Nuclear Research (JINR), Dubna, Russia, 18 - 26 April 2004
Dr GRIESER, Manfred	Max Planck Institute für Kernphysik, Heidelberg, Germany, 31 October - 12 November 2004
Prof SHEVELKO, V.P.	Lebedev Physical Institute, Russian Academy of Science, Moscow, Russia, 30 November 2004

Scope of Research

Particle and photon beams generated with accelerators and their instrumentations both for fundamental research and practical applications are studied. The following subjects are being studied: Beam dynamics related to space charge force in accelerators: Beam handling during the injection and extraction processes of the accelerator ring: Radiation mechanism of photons by electrons in the magnetic field: R&D to realize a compact synchrotron dedicated for cancer therapy; and Irradiation of materials with particle and photon beams.

Research Activities (Year 2004)

Presentations

Laser Equipped Ion Storage and Cooler Ring, S-LSR, Noda A, Fadil H, Fujimoto S, Ikegami M, Iwashita Y, Nakamura S, Shirai T, Tanabe M, Tongu H, Matsukado K, Noda K, Shibuya S, Takeuchi T, Yamada S, Daido H, Kato Y, Tajima T, Beutelspacher M, Grieser M, Syresin E, Invited talk at the 3rd Asian Particle Accelerator Conference, Gyeongju, Korea, March 2004.

Laser Ion Production and its Medical Application, Noda A, Daido H, Fukumi A, Hashida M, Iwashita Y, Li Z, Matsukado K, Nakamura S, Sakabe S, Shimizu S, Shirai T, Tanabe M, Tongu H, Yamazaki A., Invited talk at Advanced Lasers and Their Applications, Jeju Island, Korea, May 2004.

Establishment of Advanced Research Center for Beam Science, Institute for Chemical Research, Kyoto University-Aiming at creation of interdisciplinary research with use of the beam, Noda A, General Lecture at Autumn Meeting of Atomic Energy Society of Japan, Kyoto, September 2004.

Permanent Final Focus Magnet, Iwashita Y, Mihara T, Kumada M, Sugiyama E, International Conference on Linear Colliders, 21 April 2004.

Velocity compliant bunching with amplitude modulation, Iwashita Y, 6th International Workshop on Neutrino Factories & Superbeams, 27 July 2004.

A Super-Strong Permanent Magnet Quadrupole with Variable Strength, Iwashita Y, Mihara T, Evgeny A, Kumada M, Spencer C.M, Sugiyama E, XXII International Linear Accelerator Conference, Lübeck, 17 August 2004.

Electron Cooling System of Hot Ion Beam at S-LSR

Electron cooler for S-LSR is designed to cool down the laser produced ion beam with the rather large energy spread of the order of ±1% after phase rotation. It is to be installed in a straight section 1.86 m in length. In Fig. 1, the cross-sectional view of the electron cooling system is shown. So as to realize a compact size, the radius of curvature of the toroid is determined to be 0.25 m and an elliptical shape of drift tube is adopted. Up to now, all the electron coolers ever used have utilized a circular shape for the drift tube and it is anticipated that the effect of space charge caused by the electron beam is not uniform. Such effect, however, is expected to be well manageable by the computer simulation. In order to realize efficient cooling rate, it is required that the temperature of the electron beam is as low as possible. As the electron is accelerated by the high voltage up to 5 kV after emission from the gun cathode, the longitudinal temperature of the electron beam is damped, but the transverse temperature remains as the value when it is emitted. So as to manage this situation, scheme to realize adiabatic expansion has been applied. For such a purpose, the magnetic field of the solenoid has been decreased from 1.5 kG at the gun region to 0.5 kG at the central cooler region. By such an expansion of factor 3, the transverse temperature of the electron beam has been decreased from 120 meV (1400 Kelvin) to 40 meV at the cooling region. With the above mentioned design, an electron cooling system has been constructed in 2004. In Fig. 2, the fabricated electron cooler is shown. The magnetic field has been evaluated with field measurement using Hall-probes. In order to keep the electron beam temperature to be low suppressing the temperature rise, it is needed to keep the uniformity of the magnetic field along the electron orbit. For such a purpose, correction coils are utilized at the transient regions between the solenoids and toroids, the effects of which has been evaluated by the field measurements and the results are indicated in Fig. 3. It is found that the homogeneity better than several x 10^{-4} in the cooling region will be realized with careful adjustment of the excitation currents of the correction coils.

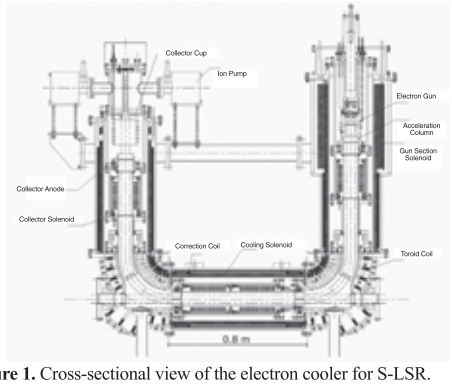

Figure 1. Cross-sectional view of the electron cooler for S-LSR.

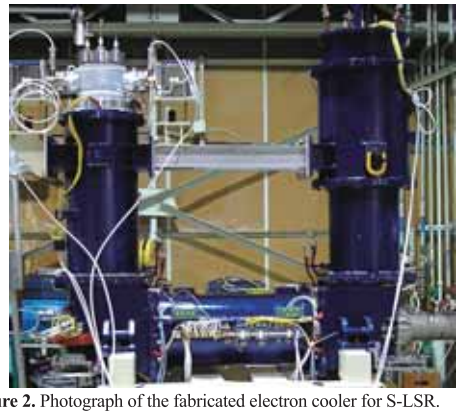

Figure 2. Photograph of the fabricated electron cooler for S-LSR.

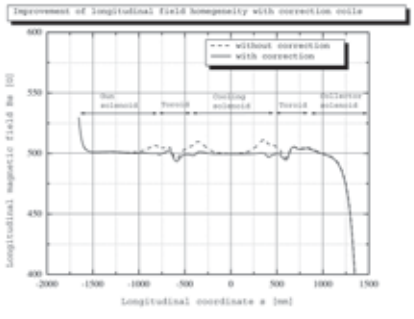

Figure 3. Improvement of the uniformity of the longitudinal field strength along the electron orbit with use of the correction coils attached at the transient regions between solenoids and troids.

Adjustable Strong Permanent Magnet for Final Focus Quadrupole, Mihara T, Iwashita Y, Kumada M, Spencer CM, The 7th ACFA workshop on Physics & Detector at the Linear Collider, 11 November 2004.

Final Doublet, Mihara T, Napoly O, First ILC Workshop, 14 November 2004.

Grants

Noda A, Beam Accumulation and Cooler Ring, Advanced Compact Accelerator Research, April 2001 - March 2006.

Iwashita Y, Super Strong Permanent Magnet for Final Focus Lens in Linear Collider, Grant-in-Aid for Scientific Research, (A) (1), April 2002 - March 2006.

Shirai T, Selective High Energy Electron Beam Extraction from Electron Storage Ring, Grant-in-Aid for Scientific Research, (C) (2), April 2004 - March 2006.